

Is Alcohol Consumption Associated with Poor Academic Achievement in University Students?

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ABSTRACT

Background: We assessed associations between educational achievement and alcohol consumption.

Methods: We employed five alcohol consumption measures (length of time of and amount consumed during most recent drinking occasion, frequency of alcohol consumption, heavy episodic drinking, problem drinking); and three educational achievement indicators (students' subjective importance of achieving good grades, students' appraisal of their academic performance in comparison with peers, students' actual module mark).

Results: Males were positively associated with all five alcohol consumption measures. Age was negatively associated with three alcohol consumption measures. While students' importance of good grades was negatively associated with three alcohol consumption measures, academic performance in comparison with peers was negatively associated with heavy episodic drinking. Actual module mark was not associated with any alcohol consumption measure.

Conclusions: Alcohol consumption showed negative associations with motivation for and subjectively achieved academic performance. University alcohol prevention activities might have positive impact on students' academic success.

Keywords: Academic performance, alcohol, educational achievement, heavy episodic drinking, problem drinking, student health, university

INTRODUCTION

The highest proportion of people with alcohol disorders are aged between 18 and 29 years,^[1] an age bracket that includes the majority of enrolled university students.^[2,3] Indeed, heavy alcohol use has been well documented among college students,^[4] and many students embrace heavy-drinking habits for the first time during their 1st year at university.^[5] About 20-25% of college students had drinking problems,^[6] or had experienced consequences related to drinking, as well as increased risk of heavy episodic drinking.^[7] Given that university study *per*

se represents a challenge to many students, an important feature related to students' drinking is their academic performance.

The relationship between problematic alcohol consumption and academic performance is a concern for university administrators and officials.^[8] Alcohol consumption has been negatively associated with academic performance,^[6] and heavy drinking has been proposed as a probable contributor to student attrition from college.^[9] Problems frequently experienced by university students due to drinking included missed classes and poor academic achievement.^[10] Heavy episodic drinkers are much more likely than non-heavy drinkers to report that drinking caused them to miss class, fall behind in their schoolwork, and perform poorly on test/s or other academic project/s.^[11,12] Similarly, others^[13] found an apparently strong association between a composite variable of alcohol involvement of university freshmen (included queries about past-month frequency of drinking ≥ 5 drinks in one sitting) and a composite variable of the academic challenges that they faced (included an assessment of whether students failed to complete their degree after 6 years). Wood *et al.* found that alcohol involvement had a modest, negative association with educational attainment after controlling for background variables.^[14] Unsurprisingly, heavy drinking and alcohol-related consequences in college students represent major challenges in some countries.^[15] Such findings have suggested that, in higher education, a strong, negative correlation exists between undergraduate alcohol use and academic performance.^[16] However, a point to note is that conversely, large-scale and well-controlled studies seem to have provided not much empirical support for the effect of heavy drinking on, e.g., attrition from college.^[17] Indeed, findings from prospective research suggested that the association between alcohol use and undergraduate academic performance is negligible.^[16]

Methodological challenges arise when attempting to understand the relationships between alcohol consumption and academic performance. Several of these challenges have to do with how alcohol consumption was measured (and number of indicators used); and

how academic performance was measured (and number of indicators used).

In terms of the first methodological challenge, in appraising the links between alcohol consumption and academic performance, alcohol consumption has been measured using many approaches. For instance, some studies employed a single item to assess alcohol use.^[13] Alternatively, in the USA, some studies^[18] examined heavy alcohol use only, whilst others assessed three alcohol consumption variables (frequency of use, amount consumed, and frequency of heavy alcohol use).^[19] Conversely, to assess university students' typical and celebration drinking, some researchers^[20] did not ask students to report the length of time that a typical drinking episode/celebratory occasion lasted, and recommended that future studies should consider this point as it has important implications for harmful outcomes associated with alcohol use. In order to bridge the range of the above shortcomings and capitalise on previous research recommendations, the current study measured alcohol consumption employing a wider approach to assess five aspects (including three types) of drinking. These included: Length of time (duration) that the last (i.e., most recent) drinking occasion lasted; amount consumed within the last (i.e., most recent) drinking occasion; frequency of alcohol consumption; heavy episodic drinking; and problem drinking.^[21]

Similarly, in connection to the second methodological challenge, university students' academic performance has also been measured in several ways. Indeed, studies could be categorized subject to the number of academic achievement indicators that were employed; and whether subjective (self-reported) or objective indicators were used. Some authors^[18] used a single self-reported measure, where students reported their cumulative grade point average (GPA). Such use of self-reported GPA supported observations^[13] that the appraisal of the links between academic performance and alcohol problems were based mostly on self-reported academic difficulties as a measure of academic performance. Other researchers^[8] used a single objective measure – academic performance data of university students that were gathered

from official university records. Moreover, other studies^[19,22] employed two objective indicators (two measures of academic performance) obtained from the registrar (student's GPA during the survey's semester and cumulative GPA at that point). Much less research employed multiple subjective and objective measures simultaneously to appraise the links between academic performance and alcohol. To bridge such shortcomings, the current study conceptualized and measured academic performance using three approaches: (1) as students' internal reflection on their academic achievement in terms of the importance they attach to achieving good grades in their studies; (2) as students' subjective comparative appraisal of their overall academic performance in comparison with their peers; and (3) as an external objective teacher evaluation of students' overall academic performance (final module marks or grades that students achieve in their course assessment/s). Such a tri-partite conceptualization of educational outcomes is supported by research in the achievement goal tradition. Two types of goals have been suggested: Performance goals (ego involvement or ability goals) that include the demonstration of competence relative to others; and mastery goals (task-involvement or learning goals) that deliberate the development of competence and task mastery.^[23] As such, achievement goals are conceptualized as the purpose^[24] or cognitive-dynamic focus^[25] of task engagement.

Given the shortcomings highlighted above in relation to measuring alcohol consumption and measuring academic performance, the current study measured alcohol consumption employing a wider approach to assess five aspects (including three types) of drinking; and also conceptualized and measured three academic achievement indicators.

Aim of the study

This study assessed the associations between five alcohol consumption variables (length of time of last drinking occasion; number of drinks consumed during the last drinking occasion; frequency of alcohol consumption, heavy episodic drinking, and problem drinking as dependent variables) and three academic achievement indicators (importance of good

grades, performance relative to peers, module mark as independent variables), whilst controlling for two socio-demographic variables (sex, age). Undergraduate students from University of Gloucestershire, UK completed a general health questionnaire, and their module grades were retrieved from the university computer systems. The specific objectives were to:

- Explore the alcohol consumption indicator/s (type of drinking) that were mostly associated with academic outcomes; and
- Explore the academic achievement measures that were mostly associated with alcohol consumption.

METHODS

Data collection procedures

Ethical approval was provided by the university research ethics subcommittee after review of study design, tool, research material, and participant information sheet (included a letter of invitation highlighting that participation is voluntary). The population for this cross-sectional research design comprised undergraduate students enrolled for classes at the University of Gloucestershire, UK during the data collection period (2008-2009). Module teachers were also provided with information about the research (aims, objectives, voluntary nature of participation), and were approached for permission to collect data from students attending their module.

The study was a general student health survey^[26] which also contained two questions about students' views on their academic performance. The survey, usually administered toward the end of a lecture/class, required \approx 15 min to complete. Each questionnaire had a participant information sheet attached. Students who remained in class to participate read the information sheet and if they wished to participate, removed and kept it for future reference. No monetary incentives nor course credit (as inducements) were provided to students for their participation. Once students completed the questionnaire, they brought it to the front of the room where it was placed in a large envelope. In the questionnaire, each participant provided her/his student registration number which was subsequently employed to import students' actual grades that they accomplished

from the university Strategic Information Technology System (SITS), and link the retrieved grades to students' responses of the health survey. The students were assured that data protection and confidentiality were observed, and that their student registration numbers would be only used import students' actual grades in an anonymous manner. The response rates were $\approx 80\%$, and for the analysis, we used data from 379 students.

Instrument

The Health and Wellbeing Questionnaire, as employed in many student health studies,^[26-32] included socio-demographic information (e.g., sex and age), as well as self-reported health behavior data (e.g., five alcohol consumption indicators):

Length of time of the last (most recent) drinking occasion (1 item): "The last time you 'partied'/socialized, how many hours did you drink alcohol?" Participants provided the number of hours.

Amount (number of drinks) of alcohol consumed during the last (most recent) drinking occasion (1 item): "The last time you 'partied'/socialized, how many alcoholic drinks did you have? (including alcoholic drinks you possibly had before going out)." Participants provided the number of drinks.

Frequency of alcohol consumption (1 item): "Over the past 3 months how often did you drink alcohol, for example, beer?" (six response options: "never," "once a week or less," "once a week," "a few times each week," "every day," and "a few times each day").

Heavy episodic drinking (1 item): "Think back again over the last 30 days. How many times (if any) have you had five or more drinks on one occasion?" (A "drink" is a glass/bottle/can of beer [≈ 50 cl], a glass/bottle/can of cider [≈ 50 cl], two glasses/bottles of alcopops [≈ 50 cl], a glass of wine [≈ 15 cl], a glass of spirits [≈ 5 cl] or a mixed drink). Response options were "never," "once," "twice," "3-5 times," "6-9 times," and "10 or more times."

Problem drinking (4 items): Data was gathered using an alcoholism-screening CAGE test,^[21] a brief screening instrument consisting of four short questions ["Have you ever felt you

should Cut down on your drinking?; Have people Annoyed you by criticizing your drinking?; Have you ever felt bad or Guilty about your drinking?; Have you ever had a drink in the morning to get rid of a hangover?" (Eye opener)]. Each question is answered either "yes" or "no". Two or three affirmative answers suggest problem drinking, while four positive responses indicate serious suspicion of alcohol dependence.

Educational achievement was measured using three indicators.^[27] The health questionnaire contained two items on students' educational achievement; the third indicator (module mark) was retrieved from university computer systems.

- Students' internal reflection on their academic achievement (importance they attach to achieving good grades) - "How important is it for you to have good grades at university?" (4 response categories, 1 = "not at all important," 4 = "very important");
- Students' subjective comparative appraisal of their overall academic performance (in comparison with their peers) "How do you rate your performance in comparison with your fellow students?" (5 response categories, 1 = "much worse," 5 = "much better"); and
- An external objective teacher evaluation of students' overall academic performance in terms of the final module marks (in percent) accomplished by students in their course assessment/s). Similar to other studies,^[28] each student's registration number was employed to import the student's module mark/grade (as percentages) from the university SITS,^[33] which was then linked to the student's questionnaire responses.^[27]

Statistical analysis

Analyses were performed using SPSS 14.0 (significance level set at $P < 0.05$). For demographic and other characteristics, frequencies were calculated separately for males and females in order to provide precise estimates. This is because sex is related to drinking and sex differences in alcohol consumption among undergraduates have been reported.^[34] In addition, sex had a significant, direct relationship with academic problems;^[13] and prospective results of young adults suggested that there might be some

important sex differences as to how a lower response or low sensitivity to alcohol is related to alcohol outcomes and future drinking problems.^[35] Sex comparisons were undertaken using Chi-square (χ^2) statistics for categorical variables and *t*-test statistics for continuous variables.

We then undertook five separate linear regression analyses to assess the relationship

of each of the three academic achievement variables (importance of good grades, performance relative to peers, module mark), controlling for the demographic variables (age, sex), on each of the five alcohol consumption measures [length of time (duration) of last drinking occasion; amount (number of drinks) consumed during the last drinking occasion; frequency of consumption;

Table 1: Demographic and other selected characteristics of sample

Variable	Whole sample (N=379)	Male (N=194)	Female (N=185)	P ^a
Age in years: Mean (SD)	22.86 (7.5)	21.22 (4.7)	24.58 (9.4)	<0.001
Duration of last drinking occasion (h): Mean (SD)	4.74 (2.7)	5.09 (2.5)	4.32 (2.5)	0.013
Number of drinks at last drinking occasion: Mean (SD)	8.16 (5.5)	10.10 (6.1)	6.39 (4.3)	<0.001
Frequency of alcohol consumption				0.040
Never	3.0	2.1	3.9	
Less than once a week	23.4	18.7	28.2	
Once a week	27.4	25.1	29.8	
Several times a week	42.7	49.2	35.9	
Every day	1.9	2.1	1.7	
Several times a day	1.6	2.7	0.6	
Heavy episodic drinking (≥ 5 drinks in a row during last month)				<0.001
None	20.4	13.0	28.2	
1 time	12.9	8.9	17.1	
2 times	12.9	14.1	11.6	
3-5 times	26.5	27.1	26.0	
6-9 times	15.8	19.8	11.6	
10 or more times	11.5	17.2	5.5	
Problem drinking (positive answers in CAGE)				0.035
1 positive answer	26.9	26.2	27.7	
2 positive answers	19.8	25.7	13.6	
3 positive answers	11.4	12.6	10.2	
4 positive answers	2.4	3.7	1.1	
Importance of having good grades at university				NS
Very important	64.1	61.7	66.7	
Somewhat important	34.3	36.3	32.2	
Not very important	1.3	1.6	1.1	
Not at all important	0.3	0.5	0.0	
Rating of one's academic performance in comparison with fellow students				NS
Much better	2.1	3.1	1.1	
Better	21.3	22.3	20.2	
The same	62.5	62.2	62.8	
Worse	13.8	12.4	15.3	
Much worse	0.3	0	0.5	
University computerized student records ^b				
Module mark-actual achieved % grade: Mean (SD)	54.56 (12.9)	53.90 (12.1)	55.68 (12.4)	NS

All cell values represent column percentages (except for variables expressed as means). ^aP value based on Chi-square statistics (χ^2) for categorical variables, and *t* test statistics for continuous variables. NS=Not significant. ^bRetrieved from university strategic Information technology system (SITS). CAGE test^[21]

heavy episodic drinking; and problem drinking]. For each regression analysis, in models 1-3, each of the three academic achievement variables was entered individually together with age and sex.

RESULTS

Alcohol consumption patterns

Male students spent more hours during the last (most recent) drinking occasion than females, and consumed more alcoholic drinks at that occasion [Table 1]. Most students (74%) consumed alcohol at least once week, and only 3% reported no alcohol consumption. Males consumed alcohol more often than females ($P < 0.04$). Half the sample (54%) testified heavy episodic drinking (≥ 5 drinks in a row) at least three times during the last month, and only 20% of respondents reported no heavy episodic drinking. The frequency of heavy episodic drinking was significantly higher among males than females ($P < 0.001$). About 31% of the sample reported two or three affirmative answers in CAGE suggesting problem drinking, while 2.4% indicated four positive responses (serious suspicion of alcohol dependence). Again, males had more positive answers in CAGE than females ($P < 0.035$).

Characteristics of academic achievement

Two-thirds of the sample (64%) felt that having good grades at university was very important for them [Table 1], and $\approx 62\%$ rated their own performance as being about the same as that of fellow students. The average module mark achieved by students was 55% (SD = 13).

There were no significant differences between males and females across the three measures of academic achievement.

Are students' duration of time of last drinking occasion or number of drinks consumed during last drinking occasion associated with academic achievement?

Neither the length (duration) of the last (most recent) drinking occasion nor the amount (number of drinks) consumed at the last occasion were significantly associated with any of the three academic achievement indicators (data not presented). However, age was consistently negatively associated with students' length of time of last drinking occasion, and also with the number of drinks consumed during the last drinking occasion. Conversely, males were positively associated with these two alcohol consumption variables (data not presented).

Is students' frequency of alcohol consumption associated with academic achievement?

When frequency of alcohol consumption was employed as the dependent variable in the regression analysis [Table 2], males were consistently positively associated with the frequency of alcohol consumption, while age was not significantly associated. Independent of age and sex, the models show that the less the importance of good grades was to students (model 1), the higher the frequency of alcohol consumption ($P < 0.05$). However, the associations between alcohol consumption frequency and the remaining two academic achievement variables (performance relative to peers-model 2; module mark-model 3) were not significant.

Table 2: Regression models for three academic achievement indicators on frequency of alcohol consumption^a as dependent variable

Variable	Model 1		Model 2		Model 3	
	Standardized β	P value	Standardized β	P value	Standardized β	P value
Age	-0.063	0.238	-0.047	0.376	0.022	0.692
Male	0.160	0.003	0.158	0.003	0.149	0.008
Importance of good grades	-0.105	0.045	-	-	-	-
Performance relative to peers	-	-	0.063	0.229	-	-
Module mark ^b	-	-	-	-	-0.015	0.787
Adjusted R ² of the model	0.04	0.001	0.03	0.004	0.01	0.066

^aFrequency of alcohol consumption (within the last 3 months)=from 'never' to 'several times a day'. ^bModule mark=Actual achieved module grade in %. Bold values indicate statistically significant associations

Is students' heavy episodic drinking associated with academic achievement?

When heavy episodic drinking was selected as the dependent variable in the regression analysis [Table 3], age was consistently negatively associated, whilst males were positively associated

with heavy episodic drinking. Controlling for age and sex, the less the students rated the importance of good grades for them (model 1) and the lower they felt their academic performance was relative to their peers (model 2), the higher the frequency of heavy episodic drinking. However, the negative

Table 3: Regression models for three academic achievement indicators on heavy episodic drinking^a as dependent variable

Variable	Model 1		Model 2		Model 3	
	Standardized β	P value	Standardized β	P value	Standardized β	P value
Age	-0.252	<0.001	-0.235	<0.001	-0.181	0.001
Male	0.210	<0.001	0.226	<0.001	0.230	<0.001
Importance of good grades	-0.142	0.004	-	-	-	-
Performance relative to peers	-	-	-0.105	0.033	-	-
Module mark ^b	-	-	-	-	-0.079	0.132
Adjusted R ² of the model	0.14	<0.001	0.13	<0.001	0.11	<0.001

^aHeavy episodic drinking: Frequency of having ≥ 5 drinks on one occasion. ^bModule mark: Actual achieved module grade in %. Bold values indicate statistically significant associations

Table 4: Regression models for three academic achievement indicators on problem drinking^a as dependent variable

Variable	Model 1		Model 2		Model 3	
	Standardized β	P value	Standardized β	P value	Standardized β	P value
Age	-0.078	0.146	-0.063	0.242	-0.048	0.400
Male	0.147	0.006	0.159	0.003	0.138	0.014
Importance of good grades	-0.104	0.047	-	-	-	-
Performance relative to peers	-	-	-0.036	0.494	-	-
Module mark ^b	-	-	-	-	-0.054	0.327
Adjusted R ² of the model	0.04	0.001	0.03	0.006	0.02	0.038

^aProblem drinking: Number of positive answers in CAGE. ^bModule mark: Actual achieved module grade in %. Bold values indicate statistically significant associations

Table 5: Associations between alcohol consumption variables and academic achievement and demographic variables

Variable	Alcohol consumption				
	Length of time ^a	Amount ^b	Frequency ^c	Heavy episodic drinking ^d	Problem drinking ^e
Academic achievement					
Male	+ve	+ve	+ve	+ve	+ve
Age	-ve	-ve	-	-ve	-
Internal reflection on academic achievement					
Importance one attaches to achieving good grades in studies	-	-	-ve	-ve	-ve
Subjective comparative self-appraisal					
One's academic performance compared to one's peers	-	-	-	-ve	-
External objective teacher evaluation					
Overall academic performance (final module mark)	-	-	-	-	-

^aLength of time of last (most recent) drinking occasion. ^bAmount (number of drinks) of alcohol consumed during the last (most recent) drinking occasion. ^cFrequency of alcohol consumption over past 3 months. ^d ≥ 5 drinks in a row. ^eCAGE score.^[21] +ve: Positive significant association, -ve: Negative significant association, -: No significant association

association with the third indicator of academic achievement (module mark) was minimal (model 3) and not significant. In addition, for heavy episodic drinking, a comparison of model 2 with model 3 showed that the importance of good grades explained more of the variation of heavy episodic drinking than performance relative to peers.

Is students' problem drinking associated with academic achievement?

When problem drinking (measured as positive "Yes" answers in CAGE) was employed as the dependent variable in the regression analysis, males were consistently positively associated with problem drinking, while age was not significantly associated [Table 4]. Controlling for age and sex, the less the students rated the importance of good grades (model 1), the higher the problem drinking ($P < 0.05$). The associations between problem drinking and performance relative to peers (model 2) and with module mark (model 3) were both not significant. Table 5 provides a summary of the relationships between alcohol consumption variables and academic achievement and demographic variables.

DISCUSSION

Some studies suggested that in countries where alcohol can be consumed, college students were more likely to consume alcohol and drink more heavily than young adults not attending university,^[36-38] and alcohol misuse/abuse is associated with negative academic achievement outcomes.^[39] A recent study in England found that 21% of their sample of 770 undergraduate students (7 universities) displayed a likelihood of having a diagnosable alcohol use disorder.^[40] Hence, university student alcohol use is a significant public health problem,^[41] and alcohol consumption on university campuses and its negative consequences have become challenges for higher education institutions.^[42] The current study assessed, in a university in the UK, the associations between five alcohol consumption variables (length of time of last drinking occasion; amount consumed during last drinking occasion, frequency of alcohol consumption, heavy episodic drinking, and problem drinking)

and three academic achievement variables, whilst controlling for two socio-demographic variables (sex, age).

In the current study, males were significantly positively associated with the five measures of alcohol consumption. This is in agreement with, e.g., a study in the USA of 200 first-year college students^[43] that reported that students increased their drinking on weekends, but this rise was more pronounced among men. Similarly, recent research of undergraduates from seven universities across England found that more men (65%) than women (58%) scored positive (8+) on the alcohol use disorders identification test (AUDIT), comprising 40% hazardous drinkers, 11% harmful drinkers, and 10% with probable dependence, although the difference in proportions between men and women categorised as AUDIT positive was not significant.^[40] Our findings are also in line with an earlier study in the UK (3075 students from 10 universities) that reported more men (61%) than women (48%) exceeded "sensible" weekly drinking limits recommended by medical authorities and that 28% of the surveyed students reported binge drinking.^[44]

Which alcohol consumption indicator/s (type of drinking) were mostly associated with academic outcomes?

As for objective one, Table 5 depicts an overview of the findings. We found relatively strong associations between heavy episodic drinking on the one hand, and the importance of good grades and the subjective academic performance relative to peers on the other, i.e., the more often students had ≥ 5 drinks on one occasion, the less they rated the importance of good grades was to them, and the lower they rated their own academic performance relative to their peers. Our current findings of negative significant relationships between heavy episodic drinking and two subjective academic achievement measures support previous research where more frequent heavy drinking was related to academic problems,^[45] lower study hours,^[46] and lower reported grades.^[47] Our findings are also compatible with that heavy episodic alcohol use has been incriminated in acute in addition to the long-term health and social

consequences.^[48,49] An important point is that in the current study, in order to determine heavy episodic drinking frequency, we employed a cutoff of consuming ≥ 5 drinks on one occasion. Such cut-off value is in line with others.^[50] However, some researchers^[18,43] determined heavy alcohol use/heavy drinking days by computing a frequency based on the consumption of ≥ 5 consecutive drinks for men; or the consumption of ≥ 4 consecutive drinks for women. Hence, in terms of females, the current study employed a higher cut-off representing a more “relaxed” measure of heavy episodic drinking. Such cut-off could have resulted in a potential underestimation of the prevalence/number of heavy episodic drinking females; and a similar underestimation of the already significant associations between academic accomplishment variables and heavy episodic drinking.

In contrast to heavy episodic drinking, two of the other alcohol consumption measures we employed (frequency of alcohol consumption; and problem drinking estimated by number of affirmative answers in CAGE) showed fewer associations with academic outcomes. Frequency of alcohol consumption and problem drinking were both only associated with lower importance of achieving good grades, but not with ratings of one’s academic performance relative to peers. The remaining two alcohol measures (length of time of last drinking occasion; amount consumed during the last drinking occasion) showed no association with the three academic achievement measures. This latter finding might be rather surprising given that the amount of drinks consumed at the last (most recent) drinking occasion could potentially be similar/parallel to heavy episodic drinking that measures the amount of alcohol consumed at one occasion. However, the questionnaire item asking only about the last drinking occasion reflects a more situational measure, in contrast to the heavy episodic drinking item that queried participant’s drinking pattern over a period of time, and thus perhaps more likely to be associated with academic performance.

Direct comparisons of our findings with other studies are difficult, because of the diversity of approaches employed in the measurement of alcohol use/misuse (e.g., time period of recall;

whether the number of drinks or actual alcohol units were employed in estimating the amount of alcohol consumed; cut-offs used for calculating heavy episodic drinking for men and for women, etc.). However, our associations between alcohol use and academic impairment were mostly demonstrated when measures of heavy episodic drinking or high risk drinking were used, as also shown in a review on the consequences of alcohol misuse in college populations.^[15]

Which academic achievement measures were mostly associated with alcohol consumption?

For objective two, the current study found that alcohol consumption was related to impairments in subjectively reported academic achievement measures (importance of achieving good grades; one’s academic achievement in comparison to one’s peers). However, we did not find associations with the objective academic achievement indicator (actual module grade) [Table 5]. Very few studies had been able to link alcohol use to students’ achieved grades that are retrieved from records/university computer systems (i.e., objective measure). For instance, one study found that the amount of alcohol consumed was a negative predictor of the cumulative GPA retrieved from students records.^[19] Similarly, research in the Netherlands found a significant association between alcohol dependency and failing the 1st year as reported from student registries.^[8] Other studies used self-reported GPA and found significant negative associations between heavy alcohol use and GPA,^[46] while in some research the association disappeared when controlling was undertaken for other factors.^[13,18]

Several reasons are proposed for the lack of an association between alcohol consumption and module grade in the current study. Methodological limitations might account for this, including our limited sample size. In addition, the student’s grade that was retrieved from the university SITS was that of a single module (the one that the student was attending when the questionnaire was completed) – this may not reflect the average (all year) final grades for any given student. It is also acknowledged that it is difficult to predict students’ grades generally, whether by using demographic and academic/educational

variables;^[51] or by using students' educational satisfaction together with a range of health status (e.g., BMI, depressive symptoms, stress, etc.) and health behavior variables (e.g., health awareness/consciousness, self-rated health, physical activity, nutrition, etc.).^[27] Hence to attempt to predict students' grades specifically by alcohol consumption represents an even more formidable challenge.^[13,18] Many other factors (e.g., age, social support, etc.) might play crucial roles and quite often alcohol drinking loses its initial significance when controlling is undertaken for such other factors.^[27] It is also likely that heavy alcohol use might not lead to lower grades directly, but indirectly through impairments in bodily/mental functions: A path diagram from a prospective study showed that amount of alcohol consumed was associated with sleepiness and negatively associated with sleep duration, which in turn had effects on students' achieved cumulative GPA.^[19] Likewise, a recent longitudinal study demonstrated that binge drinkers experienced socio-emotional problems over time which seemed to be a mechanism for the academic risk posed by drinking.^[52]

Whether the links between alcohol use and academic achievement are causal relationships remains unclear from the current cross-sectional study. It could be that straight forward cause-effect relationship exists, or that such links might be moderated by sleep, given that alcohol use is related to sleep habits where such habits and resultant daytime sleepiness could mediate alcohol's possible influence on academic performance.^[19] In addition, heavy alcohol use was associated with lower GPA both directly and indirectly through its association with fewer study hours.^[44] Bidirectional relationships might also exist, where alcohol use and academic performance impairments mutually influence each other in a vicious circle. On the one hand, the level of academic performance in high school children predicts their drinking problems as young adults independent of individual/family confounders.^[53] At university, it is also plausible that performing poorly in coursework could lead to alcohol use.^[19] On the other hand, bidirectional effects are supported by a longitudinal study showing that missing classes or falling behind

schoolwork was a result of drinking during college, but the same study also showed that high school GPA was negatively associated with heavy alcohol use.^[18] Given the uncertain time precedence among the variables, causal interpretations of the current study's data should be cautious.

This study has limitations. The study was undertaken at one university in one country, and whether results would be similar for university students of a wider socio-economic/cultural background is an empirical question. However, even prospective studies of the association between drinking and academic performance have often relied on data collected at single universities.^[8,13,18,22] Besides the actual module grade (retrieved from the university SITS system), all data was self-reported (social desirability and sociability cannot be ruled out). For instance, we did not objectively measure drinking using biological measures (e.g., breath alcohol concentration).^[16] However, self-reports from confidential and unidentified questionnaires is a commonly accepted procedure in substance use research of university students and provides data that are generally both valid and reliable.^[54] The current survey was administered only once, but there might be a need to follow up undergraduates at "tighter" time intervals employing multiple measures of consumption within the context of a semester, as significant and abrupt changes occur frequently in the individual drinking trajectories of teenagers and young adults.^[55,56] We did not find relationships between some alcohol consumption indicators and academic performance, where modest and non-significant associations were exhibited, although low statistical power may explain some of the null associations.^[57] We did not measure achievement orientation established prior to entering university, and this might affect drinking behavior in university. Whilst the alcohol indicators we employed assessed drinking during different time periods (e.g., "most recent," "30 days," "3 months."), yet, the "objective" academic measure is for a module undertaken usually in an entire academic term. Different time frames might hinder the possible linkage between specific drinking incidents and specific academic behaviors. It could also be

argued that the “objective” academic measure we employed might not be 100% “objective”: Teacher evaluations of academic performance need to consider faculty grading practices that might be biased by discipline-specific norms and instructor-level variables. The current survey employed the final module marks of students who were attending a variety of different modules, but academic performance (final module marks) were not weighted to account for course difficulty, or in terms of variations in the rigor of grading practices across academic departments and among individual faculty within departments.^[58-60]

In order to delineate cause and effect, prospective study designs are needed to examine the relation between drinking and academic performance. Such designs would need to collect baseline data on the relevant variables beginning many years before college. Given that achievement orientation and alcohol use are characteristics that are both formed prior to university, it is possible that the former might cause the latter.

In addition, to facilitate more valid comparisons, future research would benefit from some standardization, were possible, to the measures employed to estimate the various “facets” of alcohol consumption and/or types of drinking patterns. Further, periodic/regular estimation of alcohol risk and harm (along with a range of health and wellbeing variables) in nationally representative samples of university students would contribute to an evidence base that is critical for this important young adult population, a point that seems currently lacking in the UK. Furthermore, the examination of the pathway/s linking academic/educational performance and alcohol use/dependency in young adults may help identify opportunities for preventive interventions.

Our findings point to that alcohol misuse, especially heavy episodic drinking is very likely to have negative consequences on academic performance at University. Such findings echo with similar studies undertaken in secondary schools, where drinking predicted deteriorating socio-emotional functioning, with negative consequences for adolescents’ academic grades by the end of high school.^[52] The findings also echo with research of college students, where

heavy alcohol consumption (and resultant unhealthy sleep habits) have been associated with a range of behavioral challenges, including poor academic performance (Buboltz *et al.*, 2006; Perkins, 2002).^[15,61] Indeed, alcohol use disrupts learning and memory in adults (Zeigler *et al.*, 2005).^[62] Unsurprisingly, alcohol abuse is the single greatest public health hazard at American college and university campuses, and the alcohol drinking culture remains to be highly resistant to change.^[63]

Therefore, alcohol policies on campus and educational and normative campaigns for students are highly relevant. Such programs and interventions should aim at prevention of alcohol abuse of college students and on college campuses as well as cessation programs. Hence universities might wish to pay attention to their alcohol policies and enforcement as these have been reported to be inversely associated with five outcomes related to student alcohol abuse or related consequences.^[64] Likewise, campus and community coalitions/partnerships between campus leaders and senior college administrators and a range of community stakeholders can efficiently attend to the environment that may promote high-risk drinking, although few campuses work within such a structure.^[65] For high-risk college students, brief intervention approaches with such students has been successful in reducing alcohol consumption and/or related consequences,^[66] and although, many interventions for college students have traditionally been behavioral, pharmacological treatments could provide additional options.^[67] Programs could involve creating motivation to change drinking; changing the drinker’s expectancies about the effects of alcohol; clarifying norms through feedback on the drinker’s alcohol use in comparison with other students; and making available cognitive-behavioral skills training, including how to monitor daily alcohol consumption and stress management.^[67] The important point is that interventions that are selected need to be evidence-based.^[67,68]

CONCLUSIONS

At University, alcohol misuse, especially heavy episodic drinking is very likely to have

negative consequences on academic performance. Therefore, alcohol policies on campus and intervention educational and normative campaigns for students are highly relevant. In addition, future research should include prospective designs as well as objective and subjective measures for academic performance.

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